UNIT INSTRUCTIONS

OVERHAUL

TD-581B
15 MAY 1962

SYNCHRO TRANSMITTER

COLLINS PART NUMBER 229-0260-00

CLIFTON PRECISION TYPE CGC-10-AS-7

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CGC-10-AS-7 SYNCHRO TRANSMITTER - TABLE OF CONTENTS

		Page
1.	DESCRIPTION AND OPERATION	1
2.	DISASSEMBLY	2
3.	CLEANING	4
4.	INSPECTION	4
5.	REPAIR	5
6.	ASSEMBLY	5
7.	FITS AND CLEARANCES	6
8.	TESTING	7
9.	TROUBLE SHOOTING	9
10.	STORAGE INSTRUCTIONS	9
11.	SPECIAL TOOLS, FIXTURES, AND EQUIPMENT	9
12.	ILLUSTRATED PARTS LIST	10

LIST OF ILLUSTRATIONS

Figure		Page
1	CGC-10-AS-7 Synchro Transmitter, Over-all View (C906-04-P)	ii
2	Table of Leading Particulars for the CGC-10-AS-7 Synchro Transmitter	1
3	CGC-10-AS-7 Synchro Transmitter, Schematic Diagram (C906-02-3)	2
4	CGC-10-AS-7 Synchro Transmitter, Exploded View (C906-01-1X)	3
5	Table of Fits and Clearances CGC-10-AS-7 Synchro Transmitter	7
6	Table of Commercially Available Synchro Zeroing Test Fixtures	10
7	Table of Commercially Available Synchro Bridges	10

CGC-10-AS-7 Synchro
Transmitter, Over-all
View
Figure 1

CGC-10-AS-7 SYNCHRO TRANSMITTER

1. DESCRIPTION AND OPERATION.

A. General.

This manual provides overhaul instructions and a parts list for the type CGC-10-AS-7 Synchro Transmitter. See figure 1. The CGC-10-AS-7 Synchro Transmitter is manufactured by the Clifton Precision Products Co., Clifton Heights, Pennsylvania.

B. Description of the Component.

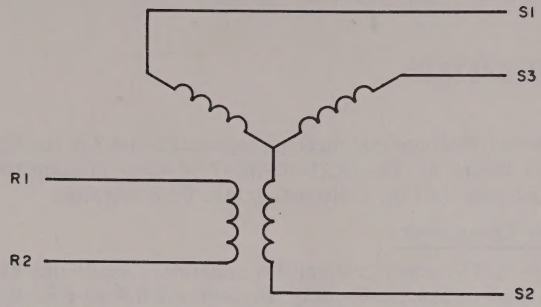
The type CGC-10-AS-7 Synchro Transmitter consists of a cylindrical housing containing a ball bearing mounted rotor, a brush assembly, and motor and stator windings. Figure 2 lists leading particulars for this component. Figure 3 is a schematic diagram of the CGC-10-AS-7.

C. Principles of Operation.

The type CGC-10-AS-7 Synchro Transmitter is a unit wherein the rotor is mechanically positioned for transmitting electrical information corresponding to angular position of the rotor with respect to the stator. A torque transmitter is constructed primarily for operation with receivers, torque differential transmitters and differential receivers. A control transmitter is constructed primarily for operation with control transformers or control differential transmitters.

Weight	1.7 oz (average)	
Length (not including rotor shaft)	1.279 inches (maximum)	
Diameter	0.937 inch (maximum)	
Operating temperature range	-55 to +95°	
Input voltage (rotor as primary)	26 volts nominal	
Input frequency (rotor as primary)	400 cps	
Input current (rotor as primary)	0.090 amp	
Input power (rotor as primary)	0.44 watt	
Ouput voltage (stator)	11.8 volts	
Sensitivity	206 mv/degree	
Phase shift	6.5 degrees leading	
Rotor d-c resistance	33 ohms	
Stator d-c resistance	11.6 ohms	
Null voltage (rms)	30 mv maximum	
Electrical error	12 minutes maximum spread	
Stator impedance Z_{so} (rotor open)	13 + j50	Measured at +25°C ±2°C with rated excitation, maximum coupling, and zero d-c in winding. Impedance component tolerances are R (±15%) + JX (±15%).
Rotor impedance Z_{rss} (stator shorted)	80 + j26	
Rotor impedance Z_{ro} (stator open)	54 + j285	

Table of Leading Particulars for the CGC-10-AS-7 Synchro Transmitter
Figure 2



COLOR CODE:
R1 – RED WITH WHITE TRACER
R2 – BLACK WITH WHITE TRACER
S1 – BLUE
S2 – BLACK
S3 – YELLOW

CGC-10-AS-7 Synchro Transmitter,
Schematic Diagram
Figure 3

2. DISASSEMBLY.

A. General.

Before disassembly of the synchro, review the exploded view, figure 4, in order to become familiar with each of the parts, the assemblies, and their relationship to each other. Protect disassembled parts from dirt, dust, and moisture.

CAUTION: DO NOT USE FORCE TO REMOVE ANY PART OF THE SYNCHRO.

B. Removal of Components.

(1) Remove screws (2, figure 4) and end plate (1).

(2) Remove screws (7), cap (3), sleeving (4 and 5) and brush block assembly (6).

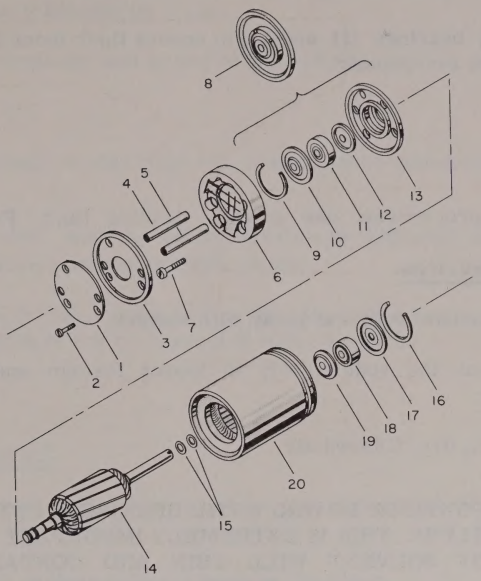
NOTE: Use a small jeweler-type screwdriver to remove screws (2 and 7).

CAUTION: DO NOT TOUCH BRUSHES DURING BRUSH BLOCK ASSEMBLY REMOVAL. ACID MOISTURE DEPOSITED BY FINGERS WILL CAUSE CORROSION AND PITTING OF THE BRUSH SURFACES.

(3) Remove bearing plate assembly (8) and disassemble as follows:

(a) Remove retainer (9), using a pair of pointed tweezers.

(b) Remove washer (10), bearing (11), and washer (12).



1. End plate
2. Screw
3. Cap
4. Sleeving
5. Sleeving
6. Brush block assembly
7. Screw
8. Bearing plate assembly
9. Retainer
10. Washer
11. Bearing
12. Washer
13. Plate
14. Rotor assembly
15. Shim
16. Retainer
17. Washer
18. Bearing
19. Washer
20. Housing assembly

CGC-10-AS-7 Synchro Transmitter, Exploded View
Figure 4

CAUTION: ALWAYS USE TWEEZERS TO PICK UP BEARINGS. ACID MOISTURE DEPOSITED BY FINGERS WILL CAUSE CORROSION.

(4) Carefully remove rotor assembly (14) with shims (15) from housing assembly (20).

CAUTION: DO NOT TOUCH SLIP RINGS ON ROTOR ASSEMBLY. ACID MOISTURE FROM THE FINGERS WILL CAUSE CORROSION AND PITTING.

NOTE: If damage occurs to either rotor assembly or housing assembly, it is recommended that the entire synchro be replaced.

(5) Remove retainer (16), using a pair of pointed tweezers.

(6) Remove washer (17), bearing (18), and washer (19).

NOTE: Tag bearings (11 and 18) to ensure their being installed in the same location upon reassembly.

3. CLEANING.

A. General.

In all cleaning procedures, use solvent cleaning fluid, Federal Specification P-S-661.

B. Cleaning of Ball Bearings.

(1) Hold bearing in tweezers and spray with solvent.

(2) Rotate one of the rods slowly to loosen foreign matter from around the balls and separator.

(3) Dry with warm, dry, filtered air.

CAUTION: CONTINUE DRYING UNTIL BEARING IS ENTIRELY FREE OF CLEANING FLUID. THIS IS EXTREMELY IMPORTANT AS THE SLIGHTEST TRACE OF SOLVENT WILL THIN AND CONTAMINATE THE LUBRICANT.

NOTE: Immediately after cleaning, lubricate bearings as described in paragraph 6.A.

C. Cleaning of Brushes and Rotor Slip Rings.

Spray with solvent cleaning fluid, Federal Specification P-S-661, and dry with warm, dry, filtered air.

CAUTION: DO NOT TOUCH BRUSHES OR ROTOR SLIP RINGS. ACID MOISTURE DEPOSITED BY FINGERS WILL CAUSE CORROSION.

D. Cleaning of Remaining Parts.

Clean remaining parts with solvent cleaning fluid, Federal Specification P-S-661, and dry with air.

4. INSPECTION.

A. Bearings.

(1) Use a jeweler's loupe in conjunction with a low-power microscope to check bearings.

(2) Inspect bearings for the presence of foreign matter within or on the bearing races. Inspect for brinelling, and cracked or broken balls and separators. Remove discoloration or rust.

(3) Inspect bearing surfaces on rotor assemblies for roughness or scoring.

B. Inspect brushes for roughness, burring, or pitting on contact areas.

C. Inspect rotor slip rings for corrosion, wear, roughness, burring, or pitting.

D. Inspect rotor laminations for indication of contact with housing assembly. Check for chipped or cracked surfaces of lamination stack.

E. Inspect insulation, windings, and soldered connections.

5. REPAIR.

Polish out minor scratches on slip rings and shaft of rotor assembly. Remove rusted paint and refinish.

NOTE: It is recommended that the entire synchro be replaced in preference to either rotor assembly or housing assembly replacement.

Replace all bearings and brushes which fail to pass the inspection procedures given in paragraph 4. Minor brush misalignment can be corrected with tweezers.

6. ASSEMBLY.

A. Lubrication of Bearings.

(1) Use lubricating oil, Dow Corning DC-510-50CS, which has been checked for contamination.

(2) Use hypodermic syringe to apply bearing lubricant.

(3) To guard against lubricant contamination, wash syringe in solvent cleaning fluid, Federal Specification P-S-661, and dry thoroughly in warm, dry, filtered air.

(4) Lubricate all moving surfaces of bearings.

(5) Following lubrication, bearings should rotate smoothly with no signs of roughness.

NOTE: Select replacement ball bearings for fit as listed in figure 5.

B. Assembly.

(1) Place washer (19) in bearing seat of housing assembly (20).

(2) Using tweezers, install bearing (18) in housing assembly.

(3) Install washer (17) and retainer (16).

(4) Check axial movement of bearing in housing bore.

(5) If necessary, disassemble components 16, 17, 18, and 19, and replace washer (19) with a washer of correct thickness to obtain the fit given in figure 5. Reassemble components 16, 17, and 18.

(6) Install shims (15) on shaft of rotor assembly (14).

(7) Hold housing assembly (20) vertically with mounting flange end up and insert rotor assembly, shimmed end up, into housing assembly and through bearing (18).

(8) Invert assembly (mounting flange end of housing assembly down).

(9) Install washer (12) in bearing bore of plate (13).

(10) Using tweezers, install bearing (11) in plate (13).

(11) Install washer (10) and retainer (9).

(12) Check axial movement of bearing in plate bore.

(13) If necessary, disassemble components 9, 10, and 11 and replace washer (12) with a washer of correct thickness to obtain the fit given in figure 5. Reassemble components 9, 10, and 11.

(14) Draw stator leads through hole in bearing plate assembly (8).

(15) Install bearing plate assembly (8) on housing assembly (20).

(16) Draw stator leads through hole in brush block assembly (6) and place brush block on bearing plate assembly (8).

NOTE: Spread brushes with tweezers to permit them to slip easily over slip rings of rotor assembly (14).

(17) Place sleeving (4 and 5) over leads and through holes in bearing plate assembly (8) and brush block assembly (6).

(18) Attach bearing plate assembly (8) and brush block assembly (6) to housing assembly (20) with screws (7).

(19) Check rotor shaft end play and radial play as described in paragraph 8.A. Refer to figure 5 for correct fit.

(20) If necessary to adjust end play, disassemble components 7, 6, 4, 5, 8, and 14. Install the correct number of shims (15) to provide the end play given in figure 5. Reassemble components 7, 6, 4, 5, 8, and 14.

(21) If necessary to correct radial play, disassemble synchro, and check bearings and bearing fits on rotor assembly and in bearing bores. Replace components as required.

(22) Check that brush tension is within the limits given in figure 5. Use tweezers to adjust, if necessary.

(23) Draw rotor and stator leads through openings in cap (3) and end plate (1).

(24) Position cap (3) and end plate (1) on brush block (6) and secure with screws (2).

NOTE: Use a small jeweler-type screwdriver to tighten screws (2 and 7).

7. FITS AND CLEARANCES.

Fits and clearances are given in figure 5.

FIGURE 4, INDEX NO.	NOMENCLATURE	FIT OR CLEARANCE
11 and 18	Ball bearing	OD to have a snug press fit in bore of bearing seat. ID to have a light slip fit on rotor shaft. Axial movement in housing to be zero.
14	Rotor assembly	End play 0.0002 to 0.0007 in. Radial play 0.0005 in. (max) Run-out 0.001 in. (max)
6	Brush block assembly	Brush tension to be 1.5 to 2.5 grams (at point of contact)

Table of Fits and Clearances, CGC-10-AS-7 Synchro Transmitter
Figure 5

8. TESTING.

A. Mechanical Tests.

Check the synchro for mechanical defects as follows:

(1) To check end play of rotor assembly (14, figure 4), apply an axial force of eight ounces to the rotor shaft. Total indicator reading should be within the limits given in figure 5.

(2) To check radial play of rotor assembly (14), apply a 4-ounce reverse gauge load to the rotor shaft within 1/8 inch of the end of the shaft. Total indicator reading, measured as close to the bearing as possible, should be within the limits given in figure 5.

(3) Check friction as follows:

Mount synchro horizontally in a vibration free test fixture capable of rotating the housing at one rpm in either direction. During test, the synchro shall be electrically unexcited and the shaft shall be elastically restrained. Determine amount of friction by optically measuring shaft deflections while shaft is rotated one complete revolution, first clockwise and then counterclockwise. Temperature should be 77°F (25°C) during test.

B. Electrical Tests.

WARNING: THE FOLLOWING TESTS MAKE USE OF HIGH VOLTAGES WHICH ARE DANGEROUS TO LIFE AND MAY BE FATAL IF CONTACTED BY OPERATING PERSONNEL. USE CARE IN WORKING WITH THE EQUIPMENT.

(1) Dielectric Strength.

Apply a potential of 500 volts (rms) a-c at a frequency of 60 cps between any one of the synchro windings and the case. The applied potential should be raised to the 500 volts (rms) from zero in not less than 5 seconds. The potential should be applied for 15 seconds.

CAUTION: DO NOT REPEAT DIELECTRIC STRENGTH TESTS ON AN ASSEMBLED SYNCHRO MORE THAN ONCE AT A VALUE IN EXCESS OF 80 PERCENT OF THE ABOVE SPECIFIED VALUE.

(2) Insulation Resistance.

(a) Apply 500 volts d-c for 5 seconds between a lead of the synchro and the housing using a Megger.

(b) Remove the 500 volts d-c and measure the insulation resistance between that lead and the case. The resistance should not be less than 20 megohms.

(c) Repeat steps (a) and (b) for the other leads of the synchro. The responses should be as in step (b).

(3) D-C Resistance Test.

Measure the d-c resistance of the rotor leads. This resistance should be 11.6 ±15 percent ohms line to line.

(4) Brush Contact Resistance.

Measure the d-c resistance of the rotor as the rotor is turned through 360 degrees at 300 rpm. This resistance shall not vary more than one ohm from the value determined in step (3) while the rotor is turned.

(5) Input Current.

The input current to the synchro, with 26 volts 400 cps applied to the rotor leads, should be 90 ma ±15 percent.

(6) Output Voltage.

The output voltage of the synchro measured across any two stator leads at maximum coupling position should be 11.8 volts ±4 percent.

(7) Accuracy Test.

(a) Mount the synchro in any of the commercially available synchro zeroing test fixtures or some other device which permits the exact indexing of the synchro from 0 to 360 degrees in precise, calibrated increments.

(b) Zero the Synchro.

1. Connect an a-c vtvm between leads S1 and S3 of the synchro.

2. Apply 26 volts, 400 cps to the rotor leads R2 and R1 of the synchro.

3. Set the rotor of the synchro to zero by setting the calibrated dial of the synchro zeroing test fixture to 0.

4. Rotate the case of the synchro until a zero indication is obtained on the a-c vtvm.

5. Connect the a-c vtvm from S1 to R1 of the synchro. Jumper S2 to R2 of the synchro. Rotate the dial of the synchro test fixture in a direction of increasing numbers. The voltage indicated on the vtvm should increase. Rotate the dial of synchro test fixture in a direction of decreasing numbers. The voltage indicated by the vtvm should decrease. If the response is not correct, the synchro has been zeroed at the wrong null.

6. Remove the jumper from S2 to R2.

(c) Connect the stator windings of the synchro to any of the commercially available synchro bridges or other balanced bridge suitable for measuring the accuracy of the synchro by the proportional voltage method.

NOTE: In general, this test conforms to the requirements of paragraph 2.2.6 of ARP 461A, Aeronautical Recommended Practice, dated 7/1/55 as revised 11/15/59.

(d) Adjust the voltage divider circuit of the synchro bridge until a null is obtained on the null detector of the synchro bridge. Read the electrical rotor position of the synchro from the voltage divider which is calibrated in degrees. Compare the electrical rotor position, as read from the voltage divider, with the mechanical rotor position as read from the calibrated dial of the synchro zeroing test fixture. The difference between these two readings is the synchro error.

(e) Check the synchro error as described in step (d) for rotor positions of 0 to 360 degrees. The error should not be more than 12 minutes of spread (±6 minutes from the 0 error position).

(8) Null Voltage Test.

The null voltage test should be performed as described in paragraph 2.2.7 of ARP 461A, Aeronautical Recommended Practice, dated 7/1/55 as revised 11/15/59. The null voltage should be 30 mv maximum.

9. TROUBLE SHOOTING.

Trouble shooting the CGC-10-AS-7 may best be accomplished by performing the tests outlined in paragraph 8 of this manual. Refer also to figures 2, 3, 4, and 5.

10. STORAGE INSTRUCTIONS.

Store overhauled synchros individually in clean, covered, wood or plastic containers containing a desiccant.

11. SPECIAL TOOLS, FIXTURES, AND EQUIPMENT.

All tools, fixtures, and equipment required to test and service the CGC-10-AS-7 Synchro Transmitter are available commercially from a variety of manufacturers. Various trade names for these equipments are used, the ones chosen in this manual being those thought to be best descriptive of the function of the equipment.

A. Synchro Zeroing Test Fixture.

The synchro zeroing test fixture should provide a rigid mount for the synchro under test. The test fixture should provide exact indexing of the synchro rotor from 0 to 360 degrees in calibrated increments of no more than 5 degrees. Figure 6 lists some of the commercially available synchro zeroing test fixtures.

MANUFACTURER	TYPE	DESCRIPTIVE NAME
Kearfott		Precise angle positioner
Bendix	13644-1A	Autosyn angular accuracy tester

Table of Commercially Available Synchro Zeroing Test Fixtures
Figure 6

MANUFACTURER	TYPE	DESCRIPTIVE NAME	NOTES
Kearfott	KT427775-2A	Synchro bridge	
Bendix	13850-1-A	Synchro proportional voltage test set	1
NOTES: 1. May be used to zero synchro and test for null voltage.			

Table of Commercially Available Synchro Bridges
Figure 7

12. ILLUSTRATED PARTS LIST.

A. Introduction.

(1) This section lists and illustrates all of the procurable assemblies and parts for the type CGC-10-AS-7 Synchro Transmitter. It is not to be taken as the authority for the procedure of assembly or disassembly, but is intended only for use in requisitioning, storing, issuing, and identifying parts, and illustrating disassembly relationships.

(2) Indexing. All parts are indexed for easy cross referencing in the exploded view given in figure 4.

(3) Part Number. The contractors' part numbers reflect certain drawing information. Part numbers consist of three sections; a one- or two-digit prefix, the basic part number, and a one-digit suffix. Example: 35-1841-2. The first two digits "35" indicate a synchro, the numerals "1841" form the basic part number, and the last digit "2" differentiates between parts or assemblies having the same basic drawing number.

(4) Nomenclature Column. The description is indented under the numbers 1 through 7 to show the relationship of one part or assembly to another part or assembly.

(5) Terms and Symbols. The following terms and symbols are used in the parts list:

No number - Not assigned complete part number
- - - Nonillustrated assembly. Assembly of which only the component parts are indexed and illustrated
AR - As required

(6) Units Per Assy Column. The number appearing in the "UNITS PER ASSY" column is the total quantity of the listed part required in its immediate assembly.

(7) Attaching Parts. Those parts used to attach parts or assemblies to the main assembly, or to each other, are designated as "(ATTACHING PARTS)". In general, these attaching parts are listed immediately following the assembly or part that they attach. The symbol "-----*-----" denotes the end of the attaching parts and the continuation of the assembly listing.

(8) Exploded View Method of Presentation.

(a) A bracket indicates a breakdown of an assembly of which only the component parts are illustrated. The bracket is assigned the index number of the assembly.

(b) To identify parts with part numbers, first locate the part and its index number in the exploded view. Find the index number in the parts list to determine the part number, nomenclature, disassembly relationship, and the units per assembly.

FIGURE & INDEX NO.	PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	USAGE CODE	UNITS PER ASSY.
4-	35-189-28	SYNCHRO TRANSMITTER		1
-1	35-144-1	. PLATE, End		1
		(ATTACHING PARTS)		
-2	35-139-2	. SCREW		3
		-----*-----		
-3	35-143-1	. CAP		1
-4	35-132-1	. SLEEVING (BLACK)		1
-5	35-132-2	. SLEEVING (RED)		1
-6	35-152-1	. BLOCK ASSY, Brush		1
		(ATTACHING PARTS)		
-7	35-114	. SCREW		3
		-----*-----		
-8	NO NUMBER	. PLATE ASSY, Bearing		1
-9	35-105	. . RETAINER		1
-10	35-104-2	. . WASHER, Dust		1
-11	OA-208	. . BEARING		1
-12	35-108	. . WASHER, Dust		1
		Consists of one each of -1 and one each of -2 (Select)		
-13	35-102	. . PLATE, Bearing		1

FIGURE & INDEX NO.	PART NO.	NOMENCLATURE 1 2 3 4 5 6 7	USAGE CODE	UNITS PER ASSY.
4-14	35-180-2	. ROTOR, ASSY		
-15	35-121	. SHIM Consists of one each of the following parts: -80, -85, -90, -95, -100, -105, -110, -115, -120, -125, -130, -135, -140, -145, -150, -155 (Select at assembly)		AR
-16	35-105	. RETAINER		1
-17	35-104-1	. WASHER, Dust		1
-18	OA-200	. BEARING		1
-19	35-108	. WASHER, Dust Consists of -1 and one each of -2 (Select)		1
-20	35-134-5	. HOUSING ASSEMBLY		1